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Study of cardiac complications in organophosphate compound poisoning

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Abstract
Background and Objective: organophosphorous (op) pesticides are one of the common compound used for poisoning, in severe forms, often leading to cardiovascular complication and death. Not many studies have been done to show the cardiac involvement in organophosphorus compound poisoning. Hence this is an attempt to study the cardiac complications in organophosphorus poisoning and to determine how it affects the outcome.
Method: 50 patients with alleged history of organophophorus compound consumption with no prior cardiovascular comorbidites who admitted at KVG medical college and Hospital, sullia during the period of October 2019 to january 2021 were selected for the study.
Results: In this study which included 50 patients of organophosphorus poisoning cases, Tachycardia (30%) was the most common clinical sign seen, followed by bradycardia (20%), hypertension (16%). Raised cardiac enzymes (Troponin T and CK-MB) were seen in 5 (10%) patients on day 3. The levels of Troponin T and CK-MB were elevated in patients with respiratory failure compared to non-failure ones.
Conclusion: In this study tachycardia was found to be the most common clinical finding. Bradycardia was associated with severe poisoning. Q-T prolongation had a prognostic significance in determining death. The level of cardiac enzymes correlated well with the severity of poisoning and prognosis, suggesting its use as a prognostic indicator of organophosphorus poisoning.

Keywords: organophosphorus poisoning; electrocardiographic changes; troponin T; CK-MB

Introduction
Organophosphorous compound (OP) poisonings are found to be a leading cause of death in agricultural countries globally. Their easy accessibility along with socio-cultural factors play a considerable role in the selection of Organophosphates as a main suicidal poison and is most often preferred by young economically productive age group with a case fatality ratio around 20 percent. OP compounds are the organic derivatives that combine with esteratic sites of acetyl cholinesterase, undergoing phosphorylation and hydrolysis. The phosphorylated enzyme is inactive and thus unable to hydrolyze acetylcholine. The biological effects of OP compound are as a result of accumulation of endogenous acetylcholine at sites of cholinergic transmission. This causes disruption of transmission of nerve impulses in both peripheral and central nervous system. Most OP compounds are readily absorbed through respiratory, oral and gastrointestinal mucous membrane, and through intact skin, as they are lipid soluble. This binding is irreversible. Cardiac complications often accompany poisoning with these compounds, which may be serious and often fatal. These complications are potentially preventable if they are recognised early and treated adequately. The extent, frequency, and pathogenesis of the cardiac toxicity from these compounds has not been clearly defined. besides from direct toxic effects of the organophosphate compounds, an increase in sympathetic and/or parasympathetic activity, hypoxemia, acidosis and electrolyte abnormalities are thought to be involved in myocardial damage associated with organophosphate poisoning. The cardiac complications range from innocuous electrocardiographic manifestations, such as sinus tachycardia to life-threatening complications including cardiogenic pulmonary edema. A few important studies have been carried out both in India and abroad to study the cardiac complications and electrocardiographic changes in OP poisoning. The current study was carried out to understand the cardiac manifestations of OP compound poisoning with special reference to cardiac enzymes.

Aim and Objectives
- To study the extent and frequency and clinical profile of myocardial involvement in various organophosphorus compound poisoning.
- To study predictors of outcomes of myocardial injury with Troponin T and Creatinine phosphokinase MB as biomarkers in organophophorus poisoning.

Methodology

In this prospective cross sectional study, 50 patients with alleged history of organophophorus compound consumption admitted at KVG medical college and Hospital, sullia D K during period of October 2019 to January 2021 were enrolled for the study. Patients with pre-existing cardiac diseases were excluded from the study. Complete blood count, cholinesterase levels, renal functions, serum electrolytes,12 lead ECG, lipid profile, chest xray, arterial blood gas analysis, 2d echocardiography, urine routine were done in our hospital set up and study was conducted.

Results

A total of 50 patients with alleged consumption of organophosphate compound were studied. Distribution of age and gender illustrated in figure 1 and 2. Most of the patients belonged to age group of 21 to 30yrs (40.23%); 15(30.01%) patients were below age of 20 years, 9(18.63%) cases were between the age group 31-40 years, 4(8.08%) individuals were between 41-50 years, and 4(8.08%) individuals were between 51-60years. Out of total 50 subjects, females constituted 61% forming the majority of study population.

As shown in table 1; Tachycardia seen in 40% of the patients was the most consistent finding, followed by bradycardia (30%), hypertension (20%) and hypotension (16%). ST elevation (32%) was the most common abnormality seen in ECG, followed by Q-T prolongation (30%), and bradycardia (20%). Q-T interval prolongation was associated with 11 of 23 (47 %) patients who developed respiratory failure and needed mechanical ventilator as compared to 1 of 26 patients (3.7 %) without respiratory failure (p value <0.0001) In the present study cardiac enzymes (Troponin I and CK-MB) which are used as an indicator of cardiac injury were positive (Troponin I ≥0.3 ng/ml and CK- MB ≥40 U/L) in 5 of 50 patients (10%) on day 3 of admission. All the 5 patients who showed raised cardiac enzymes developed respiratory failure, and 18 of 27 patients (66%) with normal cardiac enzymes developed respiratory failure (p value 0.011), indicating that patients with raised cardiac enzymes have higher chance of developing respiratory failure. Cardiac enzymes were raised 1 of 27 (4 %) patients in mild, 3 of 20 (15 %) patients in moderate and 1 of 3 (33.33 %) patients in severe poisoning. Hence raised cardiac enzymes were most commonly seen in severe poisoning, however this relationship was not statistically significant (p value 0.722).

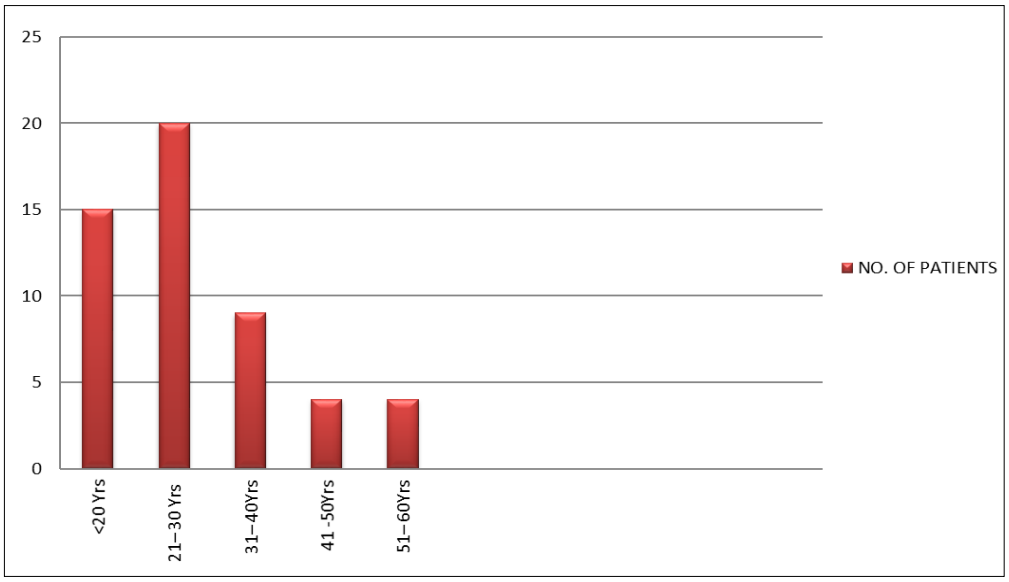

Fig 1: Age distribution of the study population

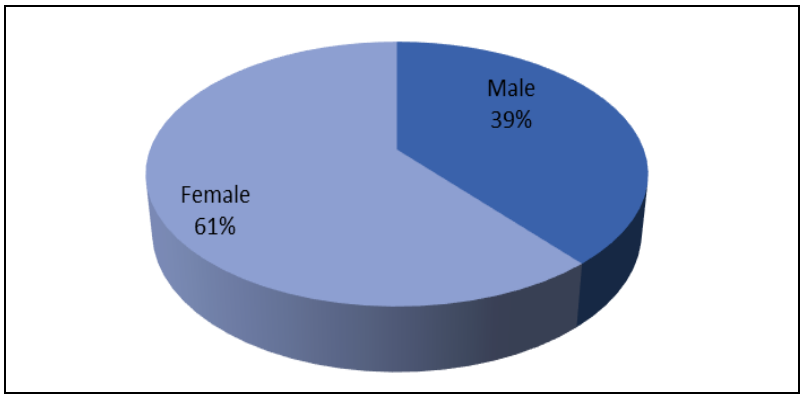

Fig 2: Gender distribution of the study population

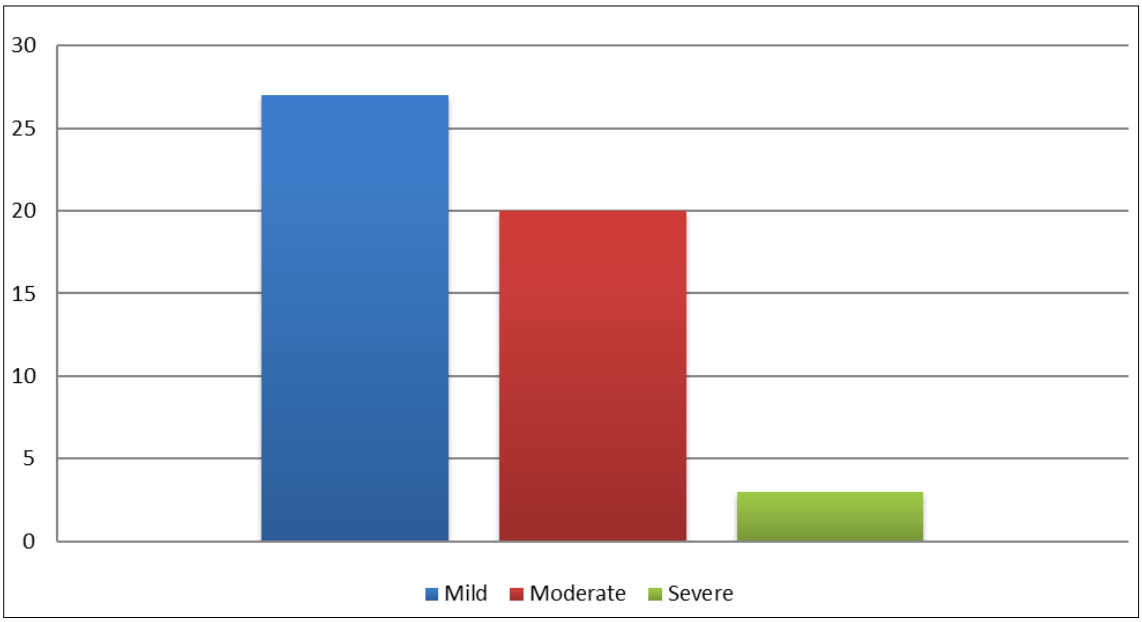

Fig 3: Distribution of patient according to their peradeniya score

Table 1: Cardiac manifestations of acute organophosphate and poisoning

	Female	Male	Total %
Electrocardiographic manifestations			
Prolonged Q*Tc interval	13	2	30%
Elevated ST segment	13	3	32%
Inverted T waves	6	4	20%
Prolonged P-R interval	3	2	10%
Exirasystole	3	2	10%
Other cardiac manifestations			
Pulmururv oedema	4	4	16
'noncardiogemc;			
Sinus tachycardia	14	6	40
Sinus bradycardia	9	6	30
Hypertension	5	5	20
Hypotension	4	4	16

Table 2: Association of Markers of Myocardial Injury with Respiratory Failure (N = 50).

	No Respiratory Failure (n=27)	Respiratory Failure (n=23)	P Value
CK-MB at 3rd day			
Positive	0	-	0.011
Negative	27	18	
Trop-T at day 3			
Positive	0	^	0.011
Negative	yj	IS	
ST Elevation			
Present	9	7	0.827
Absent	IS	16	
QT Prolongation			
Present	1	11	<0.0001
Absent	26	12	

Conclusions

Cardiac complications often accompany poisoning with these compounds, particularly during the first few hours. Hypoxaemia, acidosis, and electrolyte derangements are major predisposing factors. Most common ECG finding was ST elevation, followed by Q-T prolongation. Prolonged QT interval was found to be indicator of severity and also had a prognostic value in predicting death and respiratory failure. The positivity of cardiac enzymes was a rare occurrence, however when found was associated with higher chances of developing respiratory failure. The level of cardiac enzymes correlated well with the severity of poisoning and outcome, suggesting its use as a prognostic indicator of organophosphorus poisoning.

Limitations of the study

1. Routine biochemical recordings including serum electrolytes which influence ECG changes were not observed.
2. Due to unavailability, serum or RBC cholinesterase levels couldn't be analysed in grading the severity of poisoning.
3. Chest roentgenography findings like non-cardiogenic pulmonary edema were not included in severity grading.

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